PATENT ABSTRACTS OF JAPAN

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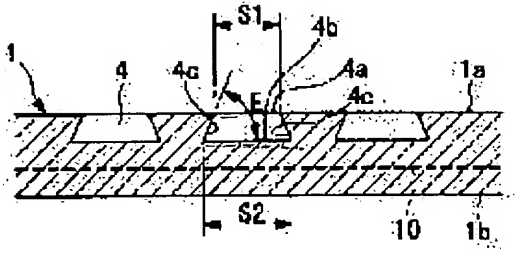
(57)Abstract:

PROBLEM TO BE SOLVED: To enhance the performance of a fuel cell by causing a reaction between a fuel gas and an oxidant gas to be efficiently performed over the whole reaction zone of a separator.

SOLUTION: A fluid passage for passing a fuel gas or an oxidant gas therethrough is provided in one surface 1a of a substrate 1 over the whole reaction zone thereof. The fluid passage is made up of a plurality of parallel and bottomed grooves 4. The cross section of the grooves 4, in the upstream of the fluid passage, is shaped into a trapezoid with the width S1 of an opening part 4a made smaller than the width S2 of a bottom part 4b and, in the downstream of the fluid passages, shaped into an inverted trapezoid with the width of the opening part 4a made larger than the width of the bottom part 4b. The grooves gradually change in cross-section shape from the upstream cross-section shape to the downstream cross-section shape. Gas, flowing in both side groove portions 4c of the bottom parts 4b of the grooves 4 in the upstream and not contributing to reaction, gradually comes to contribute to the reaction toward the downstream, and therefore the reaction is produced with efficiency substantially uniformly over the whole reaction zone of the substrate 1.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is used carrying in a portable power source or an electric vehicle, and relates to the separator of the fuel cell of which a small light weight is required.
[0002]
[Description of the Prior Art] What formed the separator which consists of an electrode plate in which the fluid channel which supplies fuel gas, such as hydrogen, to the both sides of the electrolyte membrane which consists of a phosphate water solution, a solid-state macromolecule, etc. was formed, and the separator which consists of an electrode plate in which the fluid channel which supplies oxidant gas, such as oxygen, was formed as the former and this kind of a fuel cell, respectively is known. And the cross section is a configuration with the same, almost simple dimension from the inlet port of a fluid channel to the outlet with the rectangle, and two or more slots which constitute the fluid channel of the above-mentioned separator are arranged in parallel in the shape of a straight line, and are formed (JP,59-127377,A).
[0003]
[Problem(s) to be Solved by the Invention] However, it sets to the fluid channel of the above-mentioned conventional separator. As opposed to a reaction fully being performed through opening of a slot in the upstream of this fluid channel, as for the fuel gas which flows a fluid channel, or oxidant gas, while the processing is easy, since a slot is a simple configuration Since the gas which contributes to a reaction did not fully spread round the downstream, a reaction was not performed equally in the whole reaction band of a separator, but there was a problem which cannot fully raise the output engine performance of a fuel cell. For this reason, a separator which can realize a fuel cell with the high output engine performance by the small light weight was desired.
[0004] This invention aims at offering the separator for fuel cells with which the reaction of fuel gas and oxidant gas was made to be performed in the whole reaction band of a separator efficiently. Moreover, other purposes of this invention aim at offering the separator for fuel cells which can realize a fuel cell with high power efficiency by the small light weight.
[0005]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention of claim 1 is formed along the front face of a substrate, it is the separator for fuel cells which established the fluid channel which consists of a slot of the owner bottom which turns a fluid to an outlet and pours it from an inlet port, and the slot of the above-mentioned fluid channel is considering as the configuration currently formed in the cross section configuration which enlarged width of face by the side of a pars basilaris ossis occipitalis while it makes small width of face by the side of opening of a slot in the upstream of a fluid channel.
[0006] In the upstream of a fluid channel, fuel gas and oxidant gas contact through opening of a slot, a reaction is performed in the equipment of the above-mentioned configuration, the gas which flows the both-sides deep part of the slot which does not face the above-mentioned opening will not react in the

upstream, but will flow to the downstream, and will contribute to a reaction there, and a reaction is performed efficiently in the whole reaction band ranging from the upstream to the downstream in the gas which flows a fluid channel.

[0007] It can consider as the configuration currently formed in the cross-section configuration which made small width of face by the side of a pars basilaris ossis occipitalis in equipment according to claim 1 while enlarging width of face by the side of opening of a slot in the downstream of a fluid channel (claim 2). Moreover, in equipment according to claim 1 or 2, the slot on the fluid channel can be considered as the configuration currently formed by carrying out gradual change to the cross-section configuration of the downstream from the cross-section configuration of the upstream (claim 3). With these configurations, the gas which did not contribute to a reaction by the upstream comes to contribute to a reaction in the downstream gradually, and a reaction is performed almost equally in the whole reaction band.

[0008] In equipment according to claim 2 or 3, the slot on the fluid channel can be considered as the configuration in which the cross-section configuration of the upstream was formed in trapezoidal shape, and the cross-section configuration of the downstream was formed in reverse trapezoidal shape (claim 4). Moreover, in the equipment of any one publication of claim 1 thru/or claim 4, the slot on the fluid channel can be considered as the configuration formed by joining the substrate configuration member which constitutes the pars basilaris ossis occipitalis of a slot to the substrate configuration member which constitutes the wall surface of a slot by the through hole (claim 5). Processing which forms the slot on the fluid channel in a substrate with these configurations is easy. In the equipment of any one publication of claim 1 thru/or claim 5, a substrate can be considered as the configuration which consists of carbon (claim 6). Lightweight-ization of a substrate product is realized with this configuration.

[0009]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to an accompanying drawing. In drawing 1 thru/or drawing 4 , 1 is an electrode plate for fuel gas which consists of a plate-like carbon plate (substrate) which carried out the abbreviation square, the 1 side of an electrolyte membrane is faced, and the fluid channel 2 which passes fuel gas to surface 1a is continued and formed in the whole reaction band 3. This fluid channel 2 is formed in the slot 4 of the owner bottom of an a large number book parallel to the direction (the vertical direction) along one side part (it is a right side part at drawing 1) of the electrode plate 1, and inlet-port edge 4x of each slot 4 are connected to the incurrent pore 6 of fuel gas through an incurrent canal 5, and outlet edge 4y of each slot 4 is connected to outflow hole 6a of fuel gas through flash groove 5a.

[0010] As the cross-section configuration of each of said slot 4 is shown in drawing 2 and drawing 3 , it sets to upstream 2a of said fluid channel 2. It is small in the width of face S1 of opening 4a, are carrying out trapezoidal shape (ant groove) which enlarged width of face S2 of pars-basilaris-ossis-occipitalis 4b, and it sets to downstream 2b of said fluid channel 2. Although it is large in the width of face S3 of opening 4a, reverse trapezoidal shape which made small width-of-face S4 of pars-basilaris-ossis-occipitalis 4b is carried out, this slot 4 covers the overall length, the depth is fixed and the cross section is also almost fixed The configuration is changing from the cross-section configuration of upstream (drawing 1 upper part side) 2a to the cross-section configuration of downstream (drawing 1 lower part side) 2b gradually. In addition, the cross-section configuration of said slot 4 can be continuously changed from upstream 2a towards downstream 2b, or can be gradually changed for every fixed die length in the middle of a fluid channel 2.

[0011] Said incurrent pore (gas incurrent pore) 6 penetrated from one surface 1a of the electrode plate 1 at surface 1b of another side in one side part (it is a right side part at drawing 1) of said electrode plate 1, the incurrent pore (water incurrent pore) 7 of cooling water, and the incurrent pore (gas incurrent pore) 8 of oxidant gas are formed in an upper part location, the mid-position, and a lower part location, respectively. Moreover, said outflow hole (effluence-of-gas hole) 6a which penetrates the electrode plate 1 similarly in the other side parts (it is a left side part at drawing 1) of said electrode plate 1, outflow hole (water outflow hole) 7a of cooling water, and outflow hole (effluence-of-gas hole) 8a of oxidant gas are prepared in a lower part location, the mid-position, and an upper part location, respectively.

Therefore, incurrent pores 6 and 8 and the outflow holes 6a and 8a are arranged in the diagonal location of the electrode plate 1.

[0012] The cooling water path 9 which pours cooling water is continued and established in the whole field corresponding to said reaction band 3 at one surface 1a of said electrode plate 1, and surface 1b (drawing 4) of another side in the opposite side. This cooling water path 9 is formed in the slot 10 of the owner bottom of an a large number book parallel to the direction (longitudinal direction) in alignment with the side section (it is an upper lower edge part at drawing 1) which intersects perpendicularly with one side part of the electrode plate 1. The inlet-port edge of each slot 10 is connected to said water incurrent pore 7 through an incurrent canal (water incurrent canal) 11, and the outlet edge of each slot 10 is connected to said water outflow hole 7a through flash groove (water flash groove) 11a. In addition, the electrode plate 12 for oxidant gas arranged to a side besides an electrolyte membrane is having the same structure as said electrode plate 1. However, since each electrode plates 1 and 12 have relation which counters mutually on both sides of an electrolyte membrane in the assembly condition of a fuel cell cel, as the electrode plate 12 is shown in drawing 5 and drawing 6 , the flow direction of the gas in the location and fluid channel 2 of said each incurrent pores 6, 7, and 8 and each outflow holes 6a, 7a, and 8a is the thing and reverse of the electrode plate 1.

[0013] When the electrode plates 1 and 12 of the above-mentioned configuration are used as a separator of a fuel cell When cooling water is supplied to the water incurrent pore 7 and oxidant gas is supplied to an incurrent pore 6 at an incurrent pore 8, respectively, fuel gas fuel gas It goes into inlet-port edge 4x of the slot 4 of upstream 2a in a fluid channel 2 through an incurrent canal 5 from the incurrent pore 6 of the electrode plate 1, and the reaction band 3 is flowed to downstream 2b, and it results in outlet edge 4y of a slot 4, and flows into outflow hole 6a through flash groove 5a further.

[0014] On the other hand, oxidant gas goes into inlet-port edge 4x of the slot 4 of upstream (lower part side of drawing 5) 2a in a fluid channel 2 through an incurrent canal 5 from the incurrent pore 8 of the electrode plate 12, flows the reaction band 3 to downstream (upper part side of drawing 5) 2b, results in outlet edge 4y of a slot 4, and flows into outflow hole 8a through flash groove 5a further. In that case, fuel gas and oxidant gas react to the basis of the existence of an electrolyte membrane mutually by flowing in counterflow in the reaction bands 3 and 3, and power is outputted from the electrode plates 1 and 12. Thus, while the fuel cell is operating Cooling water goes into each slot 10 of the cooling water paths 9 and 9 through the water incurrent canals 11 and 11 from the water incurrent pores 7 and 7 of the electrode plates 1 and 12. Further Since these cooling water paths 9 and 9 are flowed to the downstream and it flows into the water outflow holes 7a and 7a through the water flash grooves 11a and 11a, the heat generated with the above-mentioned reaction is cooled with cooling water, and operating temperature is maintained appropriately.

[0015] According to the above-mentioned configuration, the cross section of each slot 4 of the fluid channel 2 of each electrode plates 1 and 12 Since the width of face S2 of pars-basilaris-ossis-occipitalis side 4b which the width of face S1 of opening 4a which contributes to a reaction in the upstream of this fluid channel 2 is small, and does not contribute to a reaction is large Can suppress moderately the reaction of the fuel gas and oxidant gas in the upstream, and unreacted gas comes to flow mostly to the downstream through both-sides slot part 4c of pars-basilaris-ossis-occipitalis 4b which does not contribute to a reaction. Moreover, the width of face S3 of opening 4a which contributes to a reaction in the downstream is large, and since width-of-face S4 by the side of pars-basilaris-ossis-occipitalis 8b which does not contribute to a reaction is small, the unreacted gas which flowed from the upstream to the downstream often reacts [width of face] by large opening 4a. Therefore, a reaction will be performed equally in the whole reaction bands 3 and 3 of each electrode plates 1 and 12, and improvement in the engine performance of a fuel cell can be aimed at.

[0016] In addition, although the wall surface formed each slot 4 of a fluid channel 2 in the even slant face towards opening 4a to pars-basilaris-ossis-occipitalis 4b and it made the cross section trapezoidal shape and reverse trapezoidal shape with the gestalt of the above-mentioned implementation It is good also as the trapezoidal shape which made the above-mentioned wall surface the concave surface and the convex, and the cross section deformed for it, and reverse trapezoidal shape, and both the edges of

opening 4a of a slot 4 and both the edges of pars-basilaris-ossis-occipitalis 4b may be formed as a corner moderately made into the shape of radii, without considering as the corner which the straight line intersected. Although especially a limit does not have the include angle E to the field of pars-basilaris-ossis-occipitalis 4b of the wall surface of each slot 4, and based also on the magnitude of the width of face of opening 4a of a trapezoidal shape slot, 45 degrees or more are desirable from the ease of processing. As a processing means of each slot 4, cutting, an electron discharge method, shot peening, and sandblasting are applicable. Moreover, the cross-section configuration of a slot 4 may be a configuration of not only the above-mentioned configuration but a circle configuration and others. Especially the configuration inside a slot 4 is not limited that the width of face of opening 4a of a slot 4 is formed by the upstream of a fluid channel 2 smaller than the width of face of a pars basilaris ossis occipitalis, and the width of face of opening 4a of a slot 4 should just be formed by the downstream of a fluid channel 7 in short more greatly than the width of face of a pars basilaris ossis occipitalis.

[0017] Furthermore, with the gestalt of the above-mentioned implementation, although the slot 4 of the fluid channel 2 of said electrode plates 1 and 12 was formed in the single plate of a substrate as a slot of an owner bottom, as shown in drawing 7 , you may form in substrate configuration member 20a which constitutes the wall surface of a slot 4 by 4d of through holes by joining plate-like substrate configuration member 20b which constitutes the pars basilaris ossis occipitalis of said slot 4. If it does in this way, it can carry out certainly [processing of a slot 4], and easily. In this case, said cooling water path 9 can also be established in the field of the opposite side the side used as pars-basilaris-ossis-occipitalis 4b of the slot 4 in substrate configuration member 20b. Moreover, with the gestalt of the above-mentioned implementation, although the fluid channel 2 of each electrode plates 1 and 12 was formed in the shape of a straight line towards the downstream from the upstream, the whole reaction bands 3 and 3 may be covered, and it may be moved in a zigzag direction and formed in them. If it does in this way, since passage will be formed for a long time, the contact time of fuel gas and oxidant gas is fully secured, an efficient reaction is performed, and improvement in the engine performance of a fuel cell can be aimed at.

[0018] Moreover, although applied to the fuel cell which could consist of metals, such as titanium excellent not only in this but a mechanical strength, corrosion resistance, heat conductivity, etc., and used the solid-state macromolecule by using the electrode plates 1 and 12 as an electrolyte membrane although carbon constituted said electrode plates (substrate) 1 and 12 from the gestalt of the above-mentioned implementation, ****** is also good for what used the phosphoric acid solution.

[0019]

[Effect of the Invention] Like explanation, above invention according to claim 1 Since the slot of the fluid channel prepared in the substrate considered as the configuration currently formed in the cross-section configuration which enlarged width of face by the side of a pars basilaris ossis occipitalis while making small width of face by the side of opening of a slot in the upstream of a fluid channel The flowing gas a part for the both-sides slot of the slot which does not face opening of a slot in the upstream of a fluid channel A reaction will be performed efficiently in the whole reaction band, and the gas which can flow to the downstream, and can fully contribute to a reaction, therefore flows the fluid channel of a substrate toward the downstream from the upstream can offer the separator which can aim at improvement in the output engine performance of a fuel cell.

[0020] According to claim 2 and invention according to claim 3, it considers as the configuration currently formed in the cross-section configuration which made small width of face by the side of a pars basilaris ossis occipitalis while enlarging width of face by the side of opening of a slot in the downstream of a fluid channel. Moreover, since the slot on the fluid channel considered as the configuration currently formed by carrying out gradual change to the cross-section configuration of the downstream from the cross-section configuration of the upstream, the gas which did not contribute to a reaction by the upstream comes to contribute to a reaction in the downstream gradually, and a reaction is performed almost equally in the whole reaction band. For this reason, the separator which can aim at much more improvement in the output engine performance of a fuel cell can be offered.

[0021] According to claim 4 and invention according to claim 5, the slot on the fluid channel It

considers as the configuration in which the cross-section configuration of the upstream was formed in trapezoidal shape, and the cross-section configuration of the downstream was formed in reverse trapezoidal shape. Moreover, since it considered as the configuration formed by joining the substrate configuration member which constitutes the pars basilaris ossis occipitalis of a slot to the substrate configuration member which constitutes the wall surface of a slot by the through hole, processing for forming the slot on the fluid channel in a substrate can be performed easily, and operation is easy. According to invention according to claim 6, since the substrate was constituted from carbon, lightweight-ization of a substrate product can be performed and it can contribute to implementation of a small lightweight fuel cell.

[Translation done.]